

Increasing Students' Mastery in Mathematics 6 through "I Love Math!"



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Abstract

This study used the quasi-experimental method of research to assess the effectiveness of the interactive learning module "I Love Math!" in teaching Grade 6 mathematics. It considered the results of the pretest and post-test given to 45 Grade Six-Humble learners in evaluating their mastery level in Math, in each of the 5 content areas in terms of number & number sense, geometry, patterns & algebra, measurement and, statistics & probability to determine significant difference in the mastery level before and after the utilization of I Love Math. Furthermore, the descriptive-survey method was also employed in the analysis of the significant difference in the mastery level when classified according to preferred learning styles. Results showed that the performance was improved from the Pretest Mean of 12.27 and 31. 35% MPS to 30.82 as the mean and 75.40% MPS. On the preferred learning styles, more students (33%) had the preference to two or more learning styles. There was no significant difference in the mastery level in each of the 5 content areas in Mathematics 6 when they were classified according to their preferred learning styles. The findings denoted the importance of ICT-interventions like "I Love Math!" especially in the initial years of Kto12 Curriculum implementation.

Keywords:

interactive learning module, learning styles, mastery level, Mathematics 6

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1. Introduction

Mathematics is described by the Philippines Department of Education (DepEd) (2013) as “*one subject that pervades life at any age and in any circumstance.*” Yet, most learners exhibit unfavorable performance and negative attitude towards Mathematics. For instance, Kennedy (2019) cites that 17% of the Americans have math anxiety which leads to negative attitudes towards math as early as first grade. The same holds true in the Philippine context where students’ attitude (Callaman & Itaas, 2020) and study habits (Capuno et.al, 2019) are significant factors in mathematics performance. One of the factors for students’ liking and disliking of mathematics is instructional factor (Mazana, Montero & Casmir, 2019). However, the use of interactive tools in mathematics increase students’ achievement (Yeh et.al, 2019).

In the Philippines, it was on June 2017 when grade six level phased into the K to 12 Basic Education Curriculum. As a standard, a K to 12 pupil must master the newly prescribed competencies in the five content areas in the curriculum which include number and number sense, measurement, geometry, patterns and algebra and probability and statistics (MATHTED & SEI, 2010). The establishment of the firm numerical foundation will equip the young mathletes’ concepts and skills essential at present life and in the more challenging years to come. However, the elementary schools nationwide could hardly catch up with the demands of the new curriculum. For instance, in Bukal Sur Elementary School in the Quezon Province, the Grade 6 Mean Percentage Score (MPS) was 51.6% for Year 2015, Quarter 1, 47.54% for Year 2016 and 50.24% for Year 2017 (TMEPA 2015-2018). This fluctuating results, which is far behind the standard of 75%, signified the implementation of an intervention.

Having struggles brought by the initial year of curriculum shift, the researcher deemed the significance to use an ICT-integrated instructional material aligned to the contents of the new curriculum. Hence, the research-based interactive learning module entitled “I Love Math!” was hereby utilized. Using experimental research method, this study assessed any significant difference in the mastery level of the Grade 6 students in number and number sense, geometry, patterns and algebra, measurement and statistics and probability. It also evaluated the learner’s preferred styles of learning in terms of activist,

reflector, theorist and pragmatist to determine any significant difference in the mastery level of the students.

2. Literature review

2.1. The K to 12 Mathematics Content Areas

The K to 12 Mathematics is a skill subject. It is likewise an instrument subject like in Science and in language. Mathematics is comprised of its very own notations and symbols and “grammar” rules, with which concepts and ideas are effectively expressed (K to 12 Mathematics Guide, 2013).

The K to 12 Mathematics five content areas includes number and number sense, measurement, geometry, patterns & algebra and statistics and probability. (1) Number and Number Sense as a strand include concepts of numbers, properties, operations, estimation and their applications. (2) Measurement includes the use of numbers and measure to describe, understand and compare mathematical and concrete objects. It focuses on attributes such as length, mass and weight, capacity, time, money, and temperature, as well as applications involving perimeter, area, surface area, volume and angle measure. (3) Geometry comprises of two- and three-dimensional figures and their relationships, spatial visualization, reasoning and geometric modelling and proofs. In (4) Patterns and Algebra, studies are about patterns, relationships, and changes among shapes and quantities. It includes the use of algebraic notations and symbols, equations and most importantly, functions, to represent and analyze relationships. Last, (5) Statistics and Probability is all about developing skills in collecting and organizing data using charts, tables and graphs; understanding, analyzing and interpreting data; dealing with uncertainty; and making predictions about outcomes (K to 12 Mathematics Guide, 2013).

2.2. Learning styles

Learning style refers to the learners' unique ways of understanding. Technically, an individual learning style refers to the preferential way in which the student absorbs, processes, comprehends and retains information (Nollen, 2015).

The study is based on the learning styles model developed by Peter Honey and Alan Mumford. These are activist, reflector, theorist, and pragmatist. Honey and Mumford

developed these learning styles, based upon the work of David Kolb's Experiential Learning Cycle.

Kolb's learning cycle proposed that people learn from experience in a cyclical way. Moreover, to learn effectively, a person must keep moving around this cycle of experiencing, reviewing, concluding and planning. Most especially for the non-numerates, completing each stage is vital as it may improve learning in the succeeding stages (Rosewell, 2005).

In connection, Honey and Mumford pointed out that there is an association between the learning cycle and learning styles. Peter Honey once emphasized that learning to learn is the most important capability since it provides the gateway to everything else a person want to develop and that how to learn is the key, if not, the key life skill itself.

To further analyze the learning style-cycle, here is an excerpt of Honey and Mumford's (1982) original definitions and the connections to the Kolb's Learning Cycle are as follows:

Activists involve themselves fully and without bias in new experiences. They enjoy the here and now, and are happy to be dominated by immediate experiences. They are open-minded, not skeptical, and this tends to make them enthusiastic about anything new. Their philosophy is: "I'll try anything once". They tend to act first and consider the consequences afterwards. In Kolb's Learning Cycle, these activist style refers to experiencing in which learners prefer learning by doing and by experiencing through various indoor and outdoor activities like games, individual and group works and the like.

Reflectors like to stand back to ponder experiences and observe them from many different perspectives. They collect data, both first hand and from others, and prefer to think about it thoroughly before coming to a conclusion. The thorough collection and analysis of data about experiences and events is what counts so they tend to postpone reaching definitive conclusions for as long as possible. Their philosophy is to be cautious. They are thoughtful people who like to consider all possible angles and implications before making a move. In Kolb's Learning Cycle, this reflector style refers to reviewing. These learners prefer learning through observations and reflections. They may directly observe an actual demonstration or performance, listen to a step-by-step procedure or instruction, or watch educational or tutorial

videos. Then, reviewing and reflecting on the presented learnings come after these observations.

Theorists adapt and integrate observations into complex but logically sound theories. They think problems through in a vertical, step-by-step logical way. They assimilate disparate facts into coherent theories. They tend to be perfectionists who will not rest easy until things are tidy and fit into a rational scheme. They like to analyze and synthesize. They are keen on basic assumptions, principles, theories models and systems thinking. Their philosophy prizes rationality and logic. "If it's logical it's good." In Kolb's Learning Cycle, this theorist style refers to concluding. These learners prefer learning by understanding, analyzing and synthesizing underlying reasons, models, concepts and relationships.

Pragmatists are keen on trying out ideas, theories and techniques to see if they work in practice. They positively search out new ideas and take the first opportunity to experiment with applications...They are essentially practical, down to earth people who like making practical decisions and solving problems. They respond to problems and opportunities 'as a challenge'. Their philosophy is "There is always a better way" and "If it works it's good". In Kolb's Learning Cycle, these pragmatist style refers to planning. These learners prefer learning by trying out things and see if they work. They also want to be engaged in problem solving in order to put learning in practice in connection and application to the real life situations.

These are the learning approaches that learners, numerates or non-numerates, usually prefer. In addition, to maximize mastery, each individual learner, especially non-numerate, must first understand his learning style and then, seek out opportunities to learn using that style. However, in becoming an effective learner or an instructional numerate moving towards achieving the mastery level, an individual should also develop the ability to learn in other styles too, moving around the learning cycle (Mobbs, 2013).

2.3. "I Love Math" Interactive Learning Module

To shed light on the problem of the school about the considerable numbers of non-numerates, the study considered the implications of the findings of the study in its resolution of utilizing an interactive learning module which is entitled "I Love Math."

“I LOVE MATH!” which is a simple web application, which provides an environment for learners to interact with the learning activity, and learn by watching the animation or visual information (Jamwell, 2012). This web page is developed through Hyper Text Markup Language (HTML) as the most widely used language on web.

“I LOVE MATH!” covers the competencies in the five content areas in Mathematics 6, namely: Number & Number Sense, Geometry, Patterns & Algebra, Measurement and Statistics & Probability. As an Interactive Learning Module, it adopts Honey & Mumford’s Learning Style Cycle (1992) which was based on Kolb’s Experiential Learning Cycle. Each of the competencies has four parts patterned after the four learning styles, namely: first, “Activist” Activity is named EXPERIENCE IT! in which learners will learn by-doing through indoor and outdoor activities; second, “Reflector” Activity is named REVIEW IT! in which learners will learn from observing, reviewing, watching videos and the like; third, “Theorist” Activity is named TRY IT! in which learners will analyze and synthesize learning through models, concepts, relationships, etc. and; fourth, “Pragmatist” Activity is named WORK ON IT! in which learners will engage in problem solving to put learning in practice in connection to the real world.

3. Methodology

The study used Quasi-Experimental method of research. It considered the results of the pretest and post-test given to the Grade Six-Humble learners in evaluating their mastery level in Math, in each of the 5 content areas in terms of number & number sense, geometry, patterns & algebra, measurement and, statistics & probability. The significant difference in the mastery level before and after the utilization of “I Love Math” was analyzed. Furthermore, this study also used the descriptive-survey method of research for the analysis of the significant difference in the mastery level when classified according to their preferred learning styles.

This study was conducted in Bukal Sur Elementary School where the researcher serves as an elementary grade teacher. This school adopts a departmentalized teaching from Grade 4 to Grade 6. In terms of curriculum innovations, the school had started to create and

implement school continuous improvement projects in connection to the development of reading skills, as the first priority improvement area of the School Improvement Plan (SIP).

In determining the mastery level and the learning styles, the subjects of the study are the learners of Grade Six-Humble of Bukal Sur Elementary School. These participants were chosen to help them grasp the competencies in Mathematics towards building solid foundation before they finally explore more advanced competencies in high school Mathematics. A total of 45 learners were the actual sources of data.

In the conduct of the study, the research utilized the District Numeracy Test for the mastery level and a survey questionnaire for the learning styles.

To determine the mastery level of the students, the District Numeracy Test, which is a 40-item test, included the five content areas of Mathematics 6. The number of items per content area was in accordance to the number of integrated competencies each area has. Hence, the validated 40-item test have 22 items for Number and Number Sense, 3 items for Geometry, 3 items for Patterns and Algebra, 7 items for Measurement and 5 items for Statistics and Probability. In connection, the District Numeracy Scale in determining index of mastery in Mathematics was adopted to identify the mastery level in each of the five content areas, namely: 0% - 49% is Mastery Least (ML); 50% - 74% is Nearing Mastery (NM) and; 75% - 100% is Mastery (M).

To describe the learning styles of the respondents, the Honey and Mumford's (1992) Learning Style Questionnaire, which was designed to find out learning style preferences, was adopted. There are no right or wrong answers in this 80-item questionnaire. There were 20 statements per learning style. The respondents tick (/)the number of the item which they agree more than disagree; otherwise, cross (x) if disagreed more than agree. To identify the preferred learning styles of the respondents, the following was used as suggested by Honey and Mumford (1992):

7 out of 20 or above -	Prefers ACTIVIST Learning Style
12 out of 20 or above -	Prefers REFLECTOR Learning Style
11 out of 20 or above -	Prefers THEORIST Learning Style

12 out of 20 or above -

Prefers PRAGMATIST Learning Style

To gather all the necessary data, permission was requested from the school head. Upon the approval, the administration of the research instrument followed. Participants, who took the test and answered the learning styles survey-questionnaire, were gathered in one room. Separate session was done for the test and for the survey questionnaire. The researcher personally administered the data gathering so that queries of the respondents were answered at once. After the administration of the instrument, the researcher retrieved the accomplished copies of the research instruments for analysis and interpretation.

After collecting the data, measurements were needed to interpret and analyze the facts through statistical treatments such as simple arithmetic mean, percentage and t-test for paired samples with two-tailed and 0.05 margin of error. Simplified Statistics for Beginners (SSB) Software was used to aid in the calculations.

4. Results and Discussion

Table 1

Mastery Level in the five content areas in mathematics during pretest and posttest

	Mean	MPS	Mastery Level per Content Area
Pretest	12.27	31.35%	NM - Number & Number Sense
Posttest	30.82	75.40%	M – Number & Number Sense, Geometry NM – Measurement, Patterns & Algebra, Statistics & Probability

The Pretest results revealed that the mastery levels of the respondents were nearing master in number & number sense, while mastery least in the other four content areas. While, the posttest results showed that the respondents had mastery in the number & number sense and in geometry, and nearing mastery in the other three content areas. The performance was improved from the pretest mean of 12.27 and 31. 35% MPS to 30.82 mean and 75.40% MPS.

Table 2
Learning styles of the students

Learning style	F	%
Activists	14	31
Reflectors	13	28
Theorists	5	11
Pragmatists	3	7
Two or more learning styles	15	33

Regarding the preferred learning styles of the 45 respondents, 14 or 31% were activists, 13 or 28% were reflectors, 5 or 11% were theorists, 3 or 7% were pragmatists and 15 or 33% had the preference to two or more learning styles.

Table 3
The significant difference in the mastery level of the respondents in number and number sense when classified according to preferred learning styles

Source of Variation	Sum of Squares	df	Mean Square	Computed F-Value	Critical F-Value	Decision	Impression
Between	6.76	4	1.691				
Within	196.98	50	3.940	0.429	3.72	Accept H ₀	Not Significant
Total	203.75	54					

Results show that the calculated F-value 0.429 is less than the critical F-value 3.72 for a two-tailed at .05 level of significance. Hence, the null hypothesis is accepted. This indicates that there is no significant difference in the mastery level of the respondents in Number and Number Sense when they are classified according to their preferred learning styles. It implies that appropriateness of learning styles in teaching-learning Number and Number Sense competencies does not directly influence mastery level.

Table 4

The Significant Difference in the Mastery Level of the Respondents in Geometry when Classified According to Preferred Learning Styles

Source of Variation	Sum of Squares	Df	Mean Square	Computed F-Value	Critical F-Value	Decision	Impression
Between	0.25	4	0.061				
Within	31.10	50	0.622	0.099	3.72	Accept H ₀	Not Significant
Total	31.35	54					

The table shows that the computed F-value 0.099 is below the critical F-value 3.72 for a two-tailed at 0.5 level of significance. Therefore, the null hypothesis is accepted. This specifies that there is no significant difference in the mastery level of the respondents in Geometry when they are grouped according to their preferred learning styles. It denotes that the learning styles of the non-numerate respondents do not influence their mastery of Geometry competencies.

Table 5

The Significant Difference in the Mastery Level of the Respondents in Patterns & Algebra when Classified According to Preferred Learning Styles

Source of Variation	Sum of Squares	Df	Mean Square	Computed F-Value	Critical F-Value	Decision	Impression
Between	1.61	4	0.402				
Within	36.10	50	0.722	0.557	3.72	Accept H ₀	Not Significant
Total	37.71	54					

Results indicate that the calculated F-value 0.557 is less than the critical F-value 3.72 for a two-tailed at .05 level of significance. Hence, the null hypothesis is accepted. This means that there is no significant difference in the mastery level of the respondents in

Patterns and Algebra when they are classified according to their preferred learning styles. It suggests that suitability of learning styles in teaching-learning Patterns and Algebra competencies does not merely influence mastery level.

Table 6

The Significant Difference in the Mastery Level of the Respondents in Measurement when Classified According to Preferred Learning Styles

Source of Variation	Sum of Squares	Df	Mean Square	Computed F-Value	Critical F-Value	Decision	Impression
Between	3.35	4	0.838				
Within	36.28	50	0.726	1.155	3.72	Accept H ₀	Not Significant
Total	39.64	54					

The table presents that the computed F-value 1.155 is below the critical F-value 3.72 for a two-tailed at 0.5 level of significance. Therefore, the null hypothesis is accepted. This denotes that there is no significant difference in the mastery level of the respondents in Measurement when they are grouped according to their preferred learning styles. It signifies that the preferred learning styles of the non-numerate respondents do not influence their mastery of Measurement competencies.

Table 7

The Significant Difference in the Mastery Level of the Respondents in Statistics & Probability when Classified According to Preferred Learning Styles

Source of Variation	Sum of Squares	df	Mean Square	Computed F-Value	Critical F-Value	Decision	Impression
Between	0.70	4	0.175				
Within	48.68	50	0.974	1.179	3.72	Accept H ₀	Not Significant
Total	49.38	54					

To sum it up, it was found out that there is no significant difference in the mastery level in each of the five content areas in Mathematics 6 during the posttest when they were classified according to their preferred learning styles.

Table 8***T-Test on Finding the Significant Difference in the Pretest and Post Test Results***

Variables Compared	Df	Means	Computed t-Value	Critical t-Value	Decision	Impression (@ 0.05Level of Significance)
Pretest (X1) & Posttest (X2) Results in Reading	44	12.27 30.82	16.81	2.08	Reject Ho	Significant

To strengthen the findings of the study, the researcher used T-Test for dependent /paired samples to analyze if the interactive learning module “I Love Math” was effective. It resulted into a computed t-value of 16.81 which is greater than the tabulated critical value (2.08). Hence, the decision is reject the null hypothesis. Therefore, “there is a significant difference in the pupils’ performance when they took the pretest and post test.” The findings denoted the importance of ICT-interventions like “I Love Math!,” especially in the initial years of Kto12 Curriculum implementation.

Discussion

The developed research output entitled “I LOVE MATH!” or “ILM” primarily aims to aid teachers of Mathematics 6 in helping learners, especially the non-numerates, to acquire mastery of the learning competencies in the five content areas of Mathematics 6.

For the content basis, all of the five areas are incorporated into. These content areas of Mathematics 6 are Number & Number Sense, Geometry, Patterns & Algebra, Measurement

and Statistics & Probability. Therefore, the K to 12 Mathematics Curriculum Guide (2013) serves as the blueprint of the ILM. In consonance to the aforementioned curriculum guide, all the Number & Number Sense-related competencies are expected to be mastered by Grade Six pupils from the First Quarter up to the end of the Second Quarter; Geometry, Patterns & Algebra and some of Measurement competencies be mastered at the end of the Third Quarter; and the other Measurement and all the Statistics and Probability-related competencies be mastered at the end of the Fourth Quarter. (K to 12 Mathematics Curriculum Guide December 2013). Hence, if not completely mastered among all the learners after the expected timeframe, “I LOVE MATH!” will serve its purpose which is to aid teaching-learning process during remediation classes.

With regard the activities, it was found that the dominant preference of learning styles of the non-numerate respondents is the combination of two to four of the Activist, Reflector, Theorist and Pragmatist styles developed by Honey and Mumford (1992). Thus, it served as the framework of the learning module. Each of the competencies have four parts patterned to the four learning styles, namely: first, “Activist” Activity is named EXPERIENCE IT! in which learners will learn by-doing through indoor and outdoor activities; second, “Reflector” Activity is named REVIEW IT! in which learners will learn from observing, reviewing, watching videos and the like; third, “Theorist” Activity is named TRY IT! in which learners will analyze and synthesize learning through models, concepts, relationships, etc. and; fourth, “Pragmatist” Activity is named WORK ON IT! in which learners will engage in problem solving to put learning in practice in connection to the real world.

Recommended modifications in the interactive learning module were also realized as follows:

- a) Font-size must be adjusted into a minimum of 40 depending on the font-style used

- b) Colors must be adjusted especially some of the used backgrounds which prevents the convenient understanding of the context
- c) Make the word problems more contextualized
- d) Change the content of the activities in Patterns and Algebra to make it more suitable to the grade six level
- e) Separate competencies that can still be sub-tasked

5. Conclusion

This study used the quasi-experimental method of research through pretest and post-test to evaluate the mastery level in math of the 45 grade 6 learners in in each of the 5 content areas in terms of number & number sense, geometry, patterns & algebra, measurement and, statistics & probability. The significant difference in the mastery level before and after the utilization of “I Love Math” was analyzed. It also used the descriptive-survey to classify the students’ preferred learning styles. The District Numeracy Test for the mastery level and the Honey and Mumford’s (1992) Learning Style Questionnaire were utilized.

Results of the study showed that Grade 6 learners performed quite better in the Mathematics competencies under Number & Number Sense, if compared with other four (4) content areas. Other than Number & Number Sense, learners can develop mastery in the competencies under Geometry that requires no solutions/ formulas, unlike in the other three (3) content areas. With the used of “I Love Math!” as an intervention materials, the learners acquired overall mastery of the Mathematics competencies reaching the standard. The pragmatist learning style received the least preference among the non-numerate respondents. Whereas, more than thirds of the non-numerate respondents preferred two or more learning styles. Hence, the respondents must be engaged in learning activities crafted in varied learning styles or approaches to sustain interest. There is no significant difference in the mastery level of the respondents in the five content areas in Mathematics during the post-test when they were grouped according to their preferred learning styles. Hence, suitability of learning styles in teaching-learning competencies may still be incorporated, not for mere development of mastery but for the learners’ attention and motivation. “I LOVE MATH!”

ILM is created based on the assessed mastery levels and learning styles of the respondents. Hence, this ILM can be used as a supplementary material to the school's Continuous Improvement Project in dealing with numeracy performance of the learners.

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